VOLUNTARY PUBLIC UNEMPLOYMENT INSURANCE

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ABSTRACT

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Voluntary public unemployment systems, once widespread, are now limited to a handful of countries, including Denmark and Sweden. The ubiquity of subsidized, voluntary public unemployment insurance systems early in the 1900's and their persistence in the Nordic countries raise the possibility that such systems may in fact be efficient under some circumstances. Indeed in the United States a variety of public insurance programs, including flood and agricultural crop insurance, but not unemployment insurance, are voluntary. A voluntary system has the potentially positive feature of any user cost scheme, more efficient targeting of services. Conversely adverse selection may be a serious problem if risk underwriting is imperfect. Using a 10% sample of the Danish population drawn from administrative data, we exploit the voluntary nature of the Danish system to assess empirically the worker's membership decision. We also calculate the potential revenue gains from switching to a compulsory system. A compulsory system would generate a net revenue gain for the Danish U-funds, but of rather modest proportions, and with an unexpected twist--a large fraction of the additional revenue would come from low-wage workers.

I.   Introduction

Voluntary public unemployment systems are now uncommon, but were widespread in the early years of public unemployment insurance programs.[1] Many European countries first intervened in unemployment insurance markets by subsidizing existing trade union programs, i.e. the Ghent plan, both for the obvious administrative convenience and perhaps to encourage the growth of trade unions, Western (1997). Over time the bulk of these countries converted to compulsory systems, leaving only a handful of countries with voluntary systems, notably of Denmark and Sweden.[2] The ubiquity of subsidized, voluntary public unemployment insurance systems early in the 1900's and their persistence in the Nordic countries raise the possibility that such systems may in fact be efficient under some circumstances. Indeed in the United States a variety of voluntary public insurance programs are available, including flood and agricultural crop insurance. In the remainder of this paper we will explore the Danish U-fund system, including the fund membership decision.

Understanding selection into the program is critical to assessing the value of a voluntary system. A voluntary system has the potentially positive feature of any user cost financing scheme, more efficient targeting of use. Those who do not value the service need not take it up. The value of self-selection is, however, a function of the rationality of consumers, the accuracy of individual underwriting or risk assessment,

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[1]   See ILO (1955) for an excellent review of early developments in the public provision of unemployment insurance.

[2] Although Sweden adopted a compulsory system during the early 1990's, the decision was reversed a year later.

and the absence of "free-riding" possibilities. None of these can be comfortably assumed in this situation.

Although voluntary, the Danish system covers approximately 80 percent of the labor force, in large part because of a substantial government subsidy; membership fees have covered only one-third of system expenditures in recent periods. In such a situation, it is important to determine who does *not* apply for membership. The unprotected may be part of that often mystifying group of individuals who do not "take up" government transfer payments. Conversely avoidance of membership could be fully rational; indeed compulsory public unemployment insurance programs are often justified by concerns about adverse selection in the private market. Potential insurance purchasers could have private information that permits them to insure when they are at unusual risk of becoming unemployed.

We exploit the voluntary nature of the Danish system to assess empirically the worker's ability and willingness to maximize within the system. Using a 10% sample of the Danish population drawn primarily from administrative data, we are able to estimate the worker's demand function for unemployment insurance. We find substantial economic rationality in the decision process. In this policy environment, with premium underwriting absent, nonmembers are disproportionately those who face unusually low unemployment probabilities, or alternative forms of public income support. We also calculate the budget implications of making a transition to a compulsory system, computing the revenue gains that would result from such a policy change. A universal compulsory system would indeed generate a net revenue gain for the Danish U-funds, but of rather modest proportions, and with an unexpected twist that could explain the political durability of this otherwise anomalous feature of the welfare state--a large fraction of the increased revenue would come from low-wage

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workers eligible for other means-tested programs in the absence of unemployment benefits.

In the next section we consider more systematically the merits of voluntary unemployment systems. We then turn to an empirical analysis of the Danish system. Because voluntary systems are now uncommon, we describe in detail the Danish U-fund in Section III. We then explore the question of selection. We first develop a formal model of the worker's decision to join a voluntary unemployment fund (Section IV), assuming a rational agent. The membership decision requires consideration of U-fund program attributes, including underwriting of fees and benefit generosity, but also alternative forms of income support for the uninsured unemployed, including the rather generous social safety net program (social assistance). Then we briefly describe our primary data set (Section V), before turning in the following section to a multivariate analysis of fund membership (Section VI). A number of robustness tests of the estimated model are then described in Section VII. In Section VIII we consider certain age anomalies in our results. We argue that these are the consequence of the investment element of the program--the fact that a worker must belong to a fund for one year to be eligible for benefits--as well as of the eligibility requirements for a fixed benefit retirement benefit, "efterloen." Finally in Section IX we turn to the financial implications of selection in the Danish system, estimating the revenue consequences of making the system universal and compulsory.

II.   Voluntary and Compulsory Unemployment Insurance Systems

Voluntary public unemployment insurance programs are sufficiently rare that little study has been given to the potential advantages of voluntary, subsidized systems over compulsory ones. To explore that issue, we first consider the question

of why private provision of unemployment insurance fails.[3] This provides us with a framework for discussing the potential advantages of alternative forms of public intervention.

The private provision of unemployment insurance "fails" for two distinct types of reasons, (i) supplier problems, and (ii) consumer problems. Supplier problems have been discussed at length in the literature, focusing on information asymmetries. Of special relevance here are adverse selection concerns, that poor loss probability assessments or underwriting will induce adverse selection.[4] Insurers will find themselves disproportionately insuring workers with unusually high (unobserved) loss experiences.[5]

Consumer problems can be of various kinds. A concern that underlies most social insurance programs is that individuals do not voluntarily save and insure against future earnings contingencies as they would if they were better able to make the complex computations required to maximize well-being; they are myopic.[6] A second, mildly contradictory concern is that consumers (workers) are fully rational, which alas induces them to engage in "free riding" on government safety net programs. If the government provides consumption support programs for the least fortunate, the rational consumer will adjust her private affairs, including private insurance purchases, accordingly. The safety net program implicitly taxes insurance

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[3] A more complete discussion of this issue can be found in Parsons (2000).

[4] The much discussed moral hazard problem, that benefits dependent on unemployment duration will induce longer unemployment spells, i.e. Atkinson and Michelwright (1991), is of secondary importance here, moral hazard problems affect both. See however, Parsons (2000).

[5] Poor underwriting increases the cost of operating a public system, although it does not necessarily threaten its existence.

[6] Diamond (1993) stresses this element in the justification for public forced saving programs for retirement.

benefits, reducing private insurance demand. Summarizing these private insurance problems:

> (1) *supplier failure*, including adverse selection from imperfect loss underwriting;
>
> *(2)* *consumer or demand failure*, including
>> (a) consumer myopia, and;
>> (b) free-riding on public safety net programs.

The government's ability to override these private failures is uneven. Consider a voluntary public system that provides the insurance at full cost, which seems a logical response to the standard missing market argument for public insurance. Whether the government can reduce the adverse selection problem depends on its ability to impose better underwriting on the system, a task that has both informational and political dimensions. The political difficulties are especially problematic, and indeed the Danish system is notable for the complete absence of underwriting; neither premiums (fees) nor benefits are conditioned by the worker's loss probabilities.

Precisely because it suppresses individual choice, a universal, compulsory program does not suffer from the same problems. At the same time that is its weakness; a potentially important advantage a voluntary system has over a compulsory one is that of targeting efficiency. User fee systems, of which a fee based voluntary system is obviously one, have the value that the good or service, in this case, an insurance service, would not be inefficiently provided to workers who do not value appropriately. The government has little ability to assess individual risk aversion, and typically imposes a compulsory system universally or at least within the

range of the administratively feasible.[7] Almost surely this is inefficient. Whether because of temperament, asset position, or family situation, there may be many workers who simply do not value earnings insurance.

Of course the Danish system heavily subsidies the program, with membership fees that cover only one-third of costs at the time of our sample, 1995.[8] This reduces concerns about myopia or optimism bias, but at the same time compromises arguments that a voluntary system improves targeting of the system to those who would value it at full cost. An interesting social insurance design question, one that we do not answer here, is whether there is a subsidy rate that would optimally limit the myopia and free-riding distortions to a full cost voluntary system while maintaining some targeting efficiency. A compulsory system can be viewed as equivalent to a voluntary system with a subsidy rate of one hundred percent.

The efficiencies or even the financial implications to the system are difficult to predict a priori, with selection potentially being a mix of rational, free-riding consumers with risk aversion of varying intensity and of myopic consumers who may poorly calculate their net advantage in hypothetical situations. That leads us to the empirical analysis of selection in a voluntary system, which will be the focus of the remainder of this paper.

III.   The Danish Voluntary Unemployment Insurance System

Voluntary public systems are now sufficiently rare that we will describe the Danish system in some detail in this section. Danish unemployment funds (U-funds)

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[7] Firm size limits on government compulsion no doubt reflect both the higher administrative costs of mandated programs in small firms and the administrative costs of enforcing the mandate. Lower bounds on firm size in compulsory systems have been common in the U.S.

[8] The financing of the Danish system is discussed at greater detail in the next section. For a careful discussion of the Swedish system, see Bjorklund and Holmlund (1991).

are member-controlled, private funds. There are 39 state-recognized funds. In principle there is one fund for each trade, two funds for the self-employed and a general fund for both employers and employees (a Christian U-fund). Historically, the first state-recognized funds were union funds formally independent of the union organization. In theory it was possible to join the fund without joining the respective union; although in practice this was harder and sometimes impossible. From the early 1980's and onwards, the linkage between union membership and its U-fund membership was broken in practice as well as theory.

All funds are tightly regulated by the government and face identical rules on fund membership procedures, including base membership fees and benefit eligibility, levels, duration, and search requirements, although plans can and do differ in related services offered, such as search counseling services, which are linked with fee differentials. Most individuals are eligible for only one fund, although there are exceptions. After January 1, 1994, the following individuals[9] could join the fund for which their occupation or education belongs (or the Christian U-fund):

(1) employees;
(2) the self employed;
(3) working/helping spouses to the self employed;
(4) individuals with occupational or further education of 18 month or more;
(5) individuals serving their military duty.

Before January 1, 1994, employees also needed at least 150 hours of employment during the past 10 weeks from the time they sign up in order to be accepted as members.

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[9] Provided they were between 16-66 years of age and residents of Denmark

The yearly membership fee is set administratively at eight times the maximum daily UI benefit. In 1995 the fee was 3660 DKK for employees and 4071 DKK for the self-employed.[10] This pricing scheme makes the government's share of U-Fund expenditures dependent on the business cycle and implies that the funds are self-supporting when the average unemployment is approximately 3 %, ignoring fund-related leave schemes and the early retirement program ("efterloen"). Between 1975 and 1995 the average unemployment rate in Denmark was roughly 9 %, so member fees covered only one third of fund outlays. In the especially difficult year of 1992, when the rate of unemployment was 12 %, the fees covered only one-quarter of expenditures; including linked leave schemes and "efterloen," the fees covered only 1/6 of total expenditures, with the remainder covered by state subsidies and by compulsory contributions from employers.

The typical unemployed worker must pay into the U-fund for one year and have worked for at least twenty-six weeks during the three years preceding the date of unemployment to be eligible for benefits. If one joined a U fund under (4) or (5) above, one can get UI benefits without ever having had paid work. For full benefits, one must be involuntarily released; workers who voluntarily quit forfeit the first five weeks of benefits.

Benefits are 90 % of the unemployed worker's prior earnings up to a relatively low ceiling, 139,841 DKK per year in 1994, and 141,882 DKK per year in 1995. Benefit duration is extraordinary by U.S. standards. Until "reforms" in 1994, one was eligible for 9 years, with workfare requirements of six months after every 2 1/2 years

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[10] At that time, recently self employed individuals paid a higher fee, 9 times the maximum daily UF-benefits. The self-employment differential was eliminated in 1996. Part-time workers, those who work less than 31 hours per week, have both the fee and benefits reduced by one-third.

of unemployment. In practice the duration was open ended. In the period in which the data for this study was drawn, 1994 and 1995: one was eligible for benefits for seven years, although subject to workfare after four.[11]

IV. The Decision to Join an Unemployment Insurance Fund

Consider the unemployment fund membership decision of an economically rational worker who places no special weight on the source of her income; that is she is neither myopic nor is she sensitive to welfare stigma. Presumably the individual's algorithm for joining an unemployment fund is similar to that of any insurance purchase. Consider a simple one period model. The worker is assumed to have an additively separable utility function in consumption and leisure, to be risk averse in consumption, and to face a dichotomous (zero-one) work choice.[12] The ith worker's certainty utility function therefore can be represented by:

$$U = u(C_i) \qquad\qquad \text{if employed, and}$$

$$U = u(C_i) + \ell, \qquad \ell > 0, \qquad \text{if unemployed,}$$

where u is an increasing, concave function of own consumption (C_i), and ℓ is the utility of leisure. For simplicity the utility value of not working is assumed to be the same for all individuals, and sufficiently small that all individuals would choose to work if offered a job. She cannot find work of any kind in the unemployed state. We assume that the probability of becoming unemployed varies across individuals and is denoted θ_i, and that the worker maximizes expected utility,

$$E(U_i) = (1 - \theta_i)U(C_{Ei}) + \theta_i[U(C_{Ui}) + \ell], \qquad\qquad (1)$$

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[11] By 1999, benefit duration was at most 4 years, and you were subject to workfare after one year.

[12] This preference structure implies equal consumption across states if insurance is complete and costless.

where the subscripts E and U denote activities in the employed and unemployed states respectively.

It remains to specify consumption in the two states, and how consumption varies across unemployment and insurance fund membership. We first consider a simple model in which there is only the unemployment insurance fund, no general social safety net or social assistance program, and then consider the complexities introduced by the addition of alternative social programs, a reality that cannot be ignored in Denmark.

No Social Safety Net. Assume that the worker has other income A_i (capital income, spouse's earnings, etc.) and earnings of E_i when employed and earnings of zero when not. If she chooses to join an unemployment fund, she must pay a fee of f_i, and receives benefits in the amount B_i if she finds herself unemployed, with presumably $B_i > f_i$. Suppressing the individual subscripts, consumption will vary across states and insurance fund status as follows:

If uninsured, consumption will be,

$$\{C_E, C_U\} = \{E + A, A\}\,;\tag{2a}$$

If insured (with insured status denoted by a superscripted asterisk),

$$\{C_E^*, C_U^*\} = \{E - f + A, B - f + A\}\,;\tag{2b}$$

Unlike private insurance, there is no requirement that the fund be self financing and again that is emphatically not the case in the Danish unemployment insurance system.

The worker is assumed to be an expected utility maximizer, so that the decision to join an unemployment fund will involve a simple comparison of expected utilities in the two states. Define *UF* to be a binary variable equal to one if the worker

is a member of an insurance fund, zero if not. The membership decision rule can be

expressed as: join the unemployment insurance fund iff the net gain in utility (Δ) is

nonnegative:

$$\Delta = (E(U_i) \mid UF = 1) - (E(U_i) \mid UF = 0) \geq 0. \tag{3}$$

The comparative statics of this simple model are straightforward:

$$\frac{\partial \Delta}{\partial \theta} = -U(E - f + A) + U(B - f + A) + U(E + A) - U(A) > 0; \tag{4a}$$

$$\frac{\partial \Delta}{\partial f} = -(1 - \theta)U'(E - f + A) - \theta U'(B - f + A) < 0; \tag{4b}$$

$$\frac{\partial \Delta}{\partial B} = U'(B - f + A) > 0; \tag{4c}$$

$$\frac{\partial \Delta}{\partial E} = (1 - \theta)(U'(E - f + A) - U'(E + A)) > 0; \tag{4d}$$

$$\frac{\partial \Delta}{\partial A} = (1 - \theta)U'(E - f + A) + \theta U'(B - f + A)$$

$$- (1 - \theta)U'(E + A) - \theta U'(A) > < 0 \tag{4e}$$

The returns to U-fund entry are increasing in unemployment risk and in UF-benefits,

and decreasing in the size of the fee. The prior earnings effect is positive because the

marginal utility cost of paying the fixed membership fee is decreasing in income. The

asset effect is ambiguous without stronger assumptions on the curvature of the utility

function.

The Social Safety Net. The decision to join an unemployment insurance fund

is, of course, dependent on the availability of alternative government funds as it is on

private earnings and savings. The Danish social assistance program, although less

generous than unemployment insurance benefits, is generous by international

standards.   To a first approximation, these programs are substitutes and an

opportunity cost of joining an unemployment insurance fund is the loss of social

assistance payments. Social assistance benefits available to workers who do not

participate in the unemployment insurance fund are means tested; denote these benefits by $S(\gamma, A)$, where γ is a positive shift parameter and S is a non positive function of other family income, $S_1 > 0$ and $S_2 \leq 0$.

In the presence of social assistance, the consumption of the insured is unchanged and that of the insured becomes,

$$\{C_E, C_U\} = \{E + A, A + S(\gamma, A)\}. \tag{2a$'$}$$

Inequalities (4a) and (4e) must be suitably modified, and one additional comparative static rule can be derived:

$$\frac{\partial \Delta}{\partial \theta} = -U(E - f + A) + U(B - f + A) + U(E + A) - U(A + S(\gamma, A))$$

$$> 0; \tag{4a'}$$

$$\frac{\partial \Delta}{\partial A} = (1 - \theta)U'(E - f + A) + \theta U'(B - f + A) - (1 - \theta)U'(E + A)$$

$$- \theta U'(A + S)S_2 >=< 0. \tag{4e'}$$

$$\frac{\partial \Delta}{\partial \gamma} = -\theta U'(A + S)S_1 < 0. \tag{4f}$$

Fund membership is likely to be inversely related to the generosity of social assistance benefits; rational agents must effectively deal with a system, not a single program.

V.   The Data

In our empirical work we rely on data extracted from IDA (An Integrated Data Base for Labor Market Research) and the Income Tax Register, which are both maintained by Danish Statistics, the government statistical office.[13] Administrative

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[13] The data is available for a fee that is substantial by U.S. government standards. The fee is expected to cover the cost of compiling and maintaining the data set as well as the marginal cost of providing it to the user. For commercial and privacy reasons the data can only be accessed at official Danish Statistics sites.

data from a variety of government sources was compiled for a ten percent sample of the Danish population.[14]

The value of using an administrative data set to examine unemployment fund membership is clear. The involvement of the government in many facets of Danish life means that the data set contains much more demographic and economic data than would be available in U.S. administrative data. Not only does the data set contain records of U-fund membership and benefit utilization, and social assistance records, it contains the usual demographics, i.e. sex, age, marital status; presence of children in the household, educational attainment, labor force activities; and earnings, income and wealth.

The key unemployment variable, unemployed all of week 48, the fourth week in November, is not the usual survey response, but is an administrative construct and may undercount laid off workers who do not contact public services, because they believe they do not qualify for unemployment or social assistance benefits or other related services. This concern will be considered more carefully in Section VII.

Several variables must be constructed. Benefits under the unemployment fund are institutional datum and are constructed from program rules in place in 1995, the focal year of the analysis. Cash benefits are uniform across plans, with benefits rising at a fixed proportion of earnings, about 90 percent up to a fairly low maximum, after which benefits remain flat at about 140,000 DK ($20,000):

$$B_i = \min(0.9E_i, 141{,}882),$$

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[14] Although the focus of the analysis is calendar year 1995, to accommodate lagged variables and analyses of behavioral change, the sample was drawn in 1993 and sample members then followed for two years. The "1995" data set is then only approximately a 10 percent random sample for the 1995 data set.

and E of course denotes pre-unemployment earnings. [15] Since 1994 these benefits have been taxed, as have social assistance benefits, although we do not adjust for taxes here.

We can also estimate the social assistance benefits for which the individual would be eligible if she were unemployed and *uninsured*. Welfare counselors are given a non-negligible degree of discretion in the Danish welfare system so these estimates are not exact, but a similar degree of uncertainty is likely to exist in the mind of the decision-maker, who is after all speculating on her social assistance eligibility. Unlike unemployment insurance, social assistance is means tested. The system distinguishes in a modest way between asset income and other family earnings, and it is therefore necessary to partition A into these components. Denote asset income and other family earnings by a_i and family wealth by v_i. The social assistance benefits for which a married worker would be eligible when unemployed has the following form:

$$S_i = \max [0, S_i^* - a_i - v_i^*]$$

where S_i^* is 80% of the maximum unemployment benefit if the family has children, and 60% if it does not, and $v_i^* = \max(0, v_i - 10{,}000)$.

The cost of joining an unemployment insurance plan *f* is theoretically straight-forward, simply the plan's fee schedule. The fee varies with the specific plan you join, the plans offering different ancillary services, such as job training, counseling, etc.; and whether one is a student or not (there is a significant student discount). We exclude from our sample students and pensioners because they are not eligible for any

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[15] Benefits are also bounded by zero, which affects those workers with negative incomes in 1995.

kind of unemployment compensation, neither UF nor SA benefits, so that the fee is essentially constant and its impact on U-fund membership not estimable.

We require measures of unemployment risk rather than actual unemployment in two distinct exercises, in the estimation of individual U-fund decisions (Section VI), and in the calculation of the expected revenue gain from imposing universal membership in Denmark (Section IX). The first requires a subjective measure, what does the worker making the membership decision think her unemployment probability is?, the second an objective measure. We have no direct measures of the subjective probability of unemployment, and therefore make no distinction between the two concepts, assuming instead that the worker's subjective estimate of her unemployment risk is her objective probability, based on the information available in the data set.

We construct the worker's unemployment risk from a multivariate probit model of survey week unemployment status in 1995:

$$\theta = F(\tau_0 + \tau_1 Z)$$

The Z vector plausibly includes a variety of demographic variables (age, sex, etc.) and occupational and industrial characteristics; we use lagged values of occupation of employment because no measure of the occupation of currently unemployed workers is given.[16] We then derive predicted probabilities of unemployment for each individual.

Estimates of the probit model of the probability of unemployment status in the survey week are reported in Table 2. We report two models. Consider Model 1, Table 2, Column 1. Not surprisingly, education and training lead to lower levels of

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[16] Indeed our measure of unemployment is derived from these occupational categories.

unemployment. Similarly highly skilled workers, managers, and the self-employed have low unemployment rates. Somewhat less predictable is that agricultural workers, the base group, have high unemployment relative to other industries, including construction. This may be explained by the date of the measurement, the fourth week of November. Controlling for economic incentives and structural issues, the likelihood of unemployment increases sharply with age for those in their 50's and beyond, Figure 1a. Personal histories are important as well. Past unemployment experience and receipt of public funds, whether unemployment benefits or social assistance (UF/SA), are powerful predictors of unemployment in 1995.

The second model includes additional price and wealth variables, such as expected unemployment benefits for U-fund members and those on social assistance. The price variables are significant; unemployment risk is lower among workers who can expect high U-fund payouts, and high among those who can expect high social assistance payments. The impact of past income and wealth is more modest, Model 2 (Table 2 Column 2). The other estimated coefficients are robust to the addition of these variables and we construct our estimates of the worker's perception of unemployment risk using the estimates reported in Model 2.

VI.   U-Fund Membership: A Multivariate Analysis

The basic decision algorithm is described by the equation set (2a'), (2b), and Inequality (3). If we approximate the expected utility differential Δ by the linear index I and further assume that the decision to join the unemployment insurance plan is subject to a decision error ε, the decision to join the fund can be represented as:

Join an unemployment fund iff:

$$\Delta = I - \varepsilon \geq 0, \text{ or } I \geq \varepsilon,$$

where again I denotes a linear approximation to the net expected utility returns to fund membership, which could of course be negative, ε is a random variable with mean zero. We further assume that ε is normally distributed which suggests that the probability of joining the unemployment insurance pool is:

$$P\ (UF=1) = F(I),$$

where F is the normal cumulative function. This is a standard probit model, with the indicator function I of the form:

$$I = \alpha_0 + \alpha_1 \theta + \alpha_2 f + \alpha_3 B + \alpha_4 S + \alpha_5 E + \alpha_6 A + \alpha_7 X\ ,$$

where the X vector denotes various controls. One might expect the curvature of the utility function or risk aversion to be a function of age, marital status, number of children in the family, educational level, and other family income (A), including asset income and spouses earnings. One might speculate that risk aversion falls as family income rises, so that these enter negatively for this reason, making own earnings and other family income ambiguous. To summarize, the theoretical arguments suggest that: α_1, $\alpha_3 > 0$ and α_2, $\alpha_4 < 0$, with α_5, α_6 ambiguous.

The unemployment membership fund decision was then estimated using probit techniques and the results are reported in Table 3. We estimate two models, with the first, Columns 1, including only the measure of unemployment risk and the two key "price" variables, potential unemployment benefits and potential social assistance benefits if unemployed and not a U-fund member. Linear approximations, evaluated at the means of the dependent variables, are reported in Column 2. All

three variables are of the expected sign and highly significant,[17] with unemployment risk and the unemployment benefit level increasing the U-fund membership probability and the potential social assistance benefit reducing it as theory predicts. The unemployment risk coefficient implies a 0.7 percentage point increase in U-fund membership for each addition percentage point of unemployment risk. One anomaly in the data is the asymmetry in the magnitude of effect of potential unemployment benefits and potential social assistance, with the former three times larger in absolute value than the latter. Theory would suggest that it is the differential between the two that would drive behavior. Perhaps stigma exists toward social assistance receipt, even in the welfare state. In any case the workers in our sample seem sensibly strategic in their membership behaviors.

The introduction of a wide range of controls, Table 3, Column 3 with linear approximations to the probit in Column 4, does not markedly change this conclusion. The coefficients are reduced in absolute values, but remain robustly significant.[18] A one percentage point increase in unemployment risk induces a 0.6 percentage point decrease in fund membership probability. A number of factors that we might view as controls for unobserved heterogeneity in risk preferences appear to operate independent of these price incentives. Controlling for the incentives to join a fund, those with higher gross income are less likely to join, suggesting perhaps reduced risk aversion with income. Ceteris paribus, females join funds disproportionately, while

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[17] The standard error on the unemployment probability estimate has not yet been corrected to account for the fact it is an estimate and not the actual probability. Murphy and Topel (1985) prove that the standard error in this case is underestimated, and the significance measure correspondingly overestimated. We are currently constructing corrected standard errors. At this point we note that the absolute magnitude of the coefficient, which is consistently estimated here, is large.

[18] Recall the caveat about the standard error estimates of the unemployment instrument, footnote 15.

the very young and the old, no doubt for quite different reasons, avoid them. Ceteris paribus, the highly educated are only marginally more likely to join than those with the lowest level of education attainment. The education effect is not monotonic.

VII.   Some Specification Tests

A number of robustness tests were conducted on the final model of the U-fund membership decision, Table 3, Column 2. Because many labor decisions appear to be age-dependent, the sample was partitioned by age and the model rerun for the following four age groups: $A<35$, $35 \leq A < 46$, $46 \leq A < 60$, and $60 \leq A < 67$. The full results are reported in Tables 4a through 4d. Although there are some fluctuations in individual parameter values, the coefficients are remarkably robust across these subsamples. The coefficients of key variables are reported in the following table:

	A<35	35≤A<46	46≤A<60	60<A<67
$\hat{U}$	2.806	1.593	2.691	4.167
	[0.725]	[0.321]	[0.498]	[1.590]
B-UF	0.130	0.112	0.141	0.169
	[0.034]	[0.023]	[0.026]	[0.064]
B-SA	-0.027	-0.022	-0.022	-0.003
	[-0.007]	[-0.004].	[-0.004]	[-0.001]

Source: Tables 4a-4d. The linear approximation df/dx is reported in brackets.

All have the expected sign and only a single coefficient, that of B-SA in the oldest cohort, is not significant at the 1% level. Unemployment risk and the attractiveness of the U-fund and of social assistance influence the U-fund decision in strong and predictable ways.

Finally we explore two more extreme robustness tests. The first was designed to test the sensitivity of our results to underreporting of unemployment status. As

discussed earlier, the administrative data may underreport unemployment among individuals who expect to receive no payment or other assistance from the government. Only displaced workers who make themselves known to the government are recorded as unemployed. Although we do not believe this is a large number of workers in Denmark, we estimated an extreme alternative in which we assumed that all individuals in the sample who were out of the labor force were in fact unemployed. Although the coefficient estimates changed substantially, this extreme assumption did not overturn the qualitative structure of our findings.[19]

The final specification test explored the validity of the unemployment instrument used in the U-fund membership unemployment equation. Many of the variables used in the unemployment equation, including occupation and industry, could be correlated with unobserved factors which in turn determines U-Fund membership. If for example a worker is risk averse she may choose a more stable occupation and industry, ones with lower unemployment risk, at the same time that she chooses to join a U-fund. The result could lead to an underestimate of the effect of unemployment risk on U-fund membership, because risk averse individuals with low unemployment risk may choose to join an U-fund. The large and robust estimates of unemployment risk on U-fund membership provide some evidence that this is not a serious concern, but even large estimates may be downward biased.

To test this concern we estimated a model similar to our primary model, using none of the current worker characteristics. For the younger portion of the sample, those less than 35 years of age, we were able to obtain parental education and parental wealth information for a large number of observations. We thus base our

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[19] The complete results, not reported here, are available from the authors.

unemployment estimate on variables, which cannot be influenced by the individuals: sex, age, parental education, and parental wealth. Certainly parental education and parental wealth are predetermined, although perhaps less obviously uncorrelated with children's risk preferences. The unemployment fund estimate, which is based on this alternative unemployment probability estimate, can best be compared with the estimate of the complete U-fund model for the same age group in Table 4a.

The alternative unemployment estimate is presented in Table 6a. Unemployment is low for people with high parental wealth and with very high parental education; low and medium parental educations are indistinguishable with respect to the children's unemployment. The U-fund membership estimation gives qualitatively the same results as the full model in Section VI although with much lower z-values but still highly significant coefficients, see Table 6b: in the parental model the linear approximations of the marginal effects of unemployment, UF-benefits, and SA-benefits on the U-fund membership decision are 0.84, 0.02, and -0.01. In the complete U-fund model these are 0.73, 0.03, and -0.01, respectively, Table 4a.

VIII. The U-Fund Exit Decision: Age and the Efterloen

Were there no fixed entry and exit costs, the fund membership decision would be a simple one: in any period t the individual would join a U-fund if and only if the expected value of fund benefits exceeds social assistance payments by more than the fund fee:

$$\theta_t(B_t - S_t) - f_t \geq 0,$$

where:

θ_i: The probability that the ith worker will be unemployment in the survey week (equivalently the fraction of the work year lost to unemployment)

B_i: The unemployment insurance benefit of the ith worker if he or she is an insured fund member and is unemployed (on an annual basis).

S_i The social assistance payment for which the ith uncovered worker is eligible if he or she became unemployed. (annual basis).

f_i: The unemployment fund fee of the ith worker, on an annual basis

In the Danish sample this would suggest that the age profile of fund membership should be determined by (i) the unemployment profile, and (ii) the SA eligibility profile, because fee payments are fixed and benefit levels are relatively flat across ages. In particular the decline and then rise in unemployment risk with age should induce a similar decline and rise in fund membership, but a simple graph of membership versus age (Figure 1b) suggests that U-fund membership is relatively stable over a wide range of ages.

This anomaly can be explained by the fact that fund entry and exit is an investment decision, which it is for two reasons. First, it is required that fund members pay into the system for one year (as well as work for at least 26 weeks) before qualifying for unemployment benefits. Second, long time U-fund members can opt for a specific early retirement package from the age of 60. Thus the worker must consider future as well as current circumstances.

To illustrate the nature of the first investment decision, consider the simple case in which the unemployment probability increases monotonically with age ($\theta' \geq 0$) while all other factors {B, S, f} remain constant. The worker, if he enters the fund, will never exit. Denote the length of the work life by T and the year of first payment into the fund (entry) by t_c. The worker will join the fund in the first time period in which:

$$\theta_{t_c+1}(B_{t_c+1} - S_{t_c+1}) - f_{t_c+1} \geq 0, \text{ and } \sum_{t=t_c+1}^{T} \delta^{t-t_c}[\theta_t(B-S) - f] - f \geq 0.$$

The net return must be nonnegative in the first protection year and the discounted annual returns to fund membership must equal or exceed the membership fee--the one year fee payment.

Conversely consider the case in which the unemployment probability decreases monotonically with age ($\theta' \leq 0$). In this case it is transparent that the worker, if he ever joins the fund, he will do so in the first period. The decision rule is to join in the first period if and only if:

$$\sum_{t=2}^{\tau} \delta^{t-1}[\theta_t(B-S) - f] - f \geq 0.$$

where τ is the date of exit from the system (the last period in the system). If members never exit, $\tau = T$. Exit will occur in the first period in which:

$$\theta_t(B-S) - f < 0,$$

the fee exceeds the expected UI benefits in excess of social assistance. A fortiori, the discounted value of all future expected net returns is negative at this point, although it may be negative at an earlier stage as well--a negative expected present value of net returns is a sufficient, but not necessary condition for exit with monotonically declining net returns.

The entry and exit algorithms become more complex if, as appears to be the case in the current application, net returns to membership vary nonmonotonically over the work life. Fees are constant over the work life and social assistance eligibility declines monotonically with age (Figure 1c), but unemployment risk appears to increase and then decline to reach its lowest level for people between 40 and 50. Moreover there is an early retirement benefit tied to long term fund membership that

provides back-end benefits. *Efterloen* is a program that pays a fixed benefit per month to all long term fund members who retire between age 60 and age 66 (the "normal" retirement age for the pension system is 67). In 1992, the program definition of long time member was extended from ten to twenty years.

Efterloen is extremely popular and few fund members do not expect to receive some efterloen payments. Formally the program introduces a large back payment into fund benefits that would encourages workers to join the fund between age 35 and 40, and even up to age 45 if they are not already members and to remain in the fund if they are. Indeed the efterloen may induce current members in their late thirties to remain in the system despite a period of expected returns less than costs. For example, an insured worker (member) in her 39th year who would pay into the fund at age 40 and beyond in order to qualify for efterloen as well as unemployment insurance has a strong incentive to remain in the fund prior to age 40. For example if she stopped paying fee in his 39th year, she would pay fees in her fortieth year without receiving any unemployment coverage in that year. Essentially she forgoes two years of unemployment protection to save one year's fee. At age 38 she would forgo three years of protection to save two years of fee payments. In short, fund exit rates should be reduced by the knowledge that many workers plan to be members at a later date.

The 1992 reform implied that if you were not member of a U-fund by March 31, 1992, you would need to have been a member of a U-fund for 20 years out of the last 25 years *at the time where you wish to start receiving efterloen-benefits*. If you were already a U-fund member by March 31, 1992, you would need only 10 years of membership out of the last 15 years in order to qualify for efterloen. Thus if you would like to have the efterloen option when you turn 60, you will need to have been a U-fund member for 20 years from the age of 35. At that time you could receive

efterloen from the age of 60 and until 66. This means that there is a window from age 35 to age 45 during which you might join a U-fund solely or partly because of the efterloen option.[20]

Hence, people above 45 who were not U-fund members in 1993 can never earn the right to opt for efterloen. Thus, for this group we can test our theory without having to think about efterloen as a contribution factor to fund membership; just as we can for people below age 35. Therefore, we estimate our model for people who were not U-fund members in 1993 for the following age groups: 18-34, 35-45, 46-60, and 60-66 in 1995. For the first and the two last groups there is no point in joining a U-fund because you would like to have an efterloen option. Where as for the 35-45 years old you could join merely because of the efterloen option. This is exactly what our results suggest, see Tables 7a-7c.

A summary table, which also includes the corresponding numbers from the full model is presented below. For all groups, but the age group 35-45, high unemployment risk increases the likelihood of membership with coefficients compatible with the one based on the full sample. For the workers of age 35-45, who were non-members in 1993, the unemployment risk is not significant in explaining U-fund membership. The results for the age group of anyone above 46 years, who were non-members in 1993, are of particular interest because for these people only the insurance motive for joining a U-fund exists; they cannot qualify for efterloen no matter what. The result for this group represents a "clean" test of our model and both unemployment risk and UF-benefits appears to have a significant influence on membership as expected. The effects of SA-benefits are insignificant for anyone

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[20] If you become a U-fund member at the age of 43, for instance, you can get efterløn-benefits only

above 35 years of age, this is somewhat expected since few individuals are eligible

for SA-benefits in this age group.

Summary table of full sample compared to 1993 U-fund non-members.

dF/dx	AGE < 35		35 ≤ AGE < 46		46 ≤ AGE < 60		60 ≤ AGE	
	UF93 = 0	ALL	UF93 = 0	ALL	UF93 = 0	ALL	UF93 = 0	ALL
Û	0.593	0.724	0.033	0.321	0.156	0.499	0.161	1.591
	(20.92)	(56.09)	(0.84)	(22.60)	(5.80)	(42.14)	(6.13)	(34.92)
B-UF95	0.029	0.033	0.011	0.023	0.009	0.026	0.005	0.064
	(31.75)	(78.29)	(8.43)	(46.76)	(10.29)	(66.38)	(7.44)	(38.67)
B-SA95	-0.002	-0.002	-0.001	-0.004	0.0004	-0.004	-0.0004	-0.002
	(-2.48)	(-10.72)	(-0.50)	(-13.33)	(0.40)	(-10.84)	(-0.48)	(-10.20)
Number of obs.	30715	90788	10645	63271	11191	80784	3767	9851

*Note: **z-statistics in brackets.***

The investment aspect of fund membership can explain the sustained

popularity of U-fund membership as the worker ages, enters more stable jobs, and

accumulates wealth that makes her ineligible for social assistance. Of course it may

be that risk aversion increases with age as well, but this taste change is not necessary

to explain the age insensitivity of U-fund membership ceteris paribus.

IX.   Policy Simulations: Revenue Gains from Compulsion

A potential cost of voluntarism is adverse selection; specifically the threat that

high risk and therefore high cost workers are disproportionately likely to become

unemployment fund members. The probit results of the U-fund membership decision

suggest that workers do respond to the economic incentives provided by the absence

of risk underwriting; variations in unemployment risk as well as in program benefits

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when you are between age 63 and 66.

induce changes in membership behavior in the expected direction. Whether the magnitude of the effect is sufficient to have serious consequences for the financing of the U-fund system is unclear. In this section we use our 10 percent Danish sample to estimate the revenue gains that would result from instituting a universal, compulsory insurance system on Danish workers.[21]

In making these calculations it is essential to specify the range of financial implications that we want to consider. An unemployment insurance planner may not include the implications of a program rule change on related program's budget, in this case social assistance. We feel it is appropriate to consider these related savings and costs, but will compute the fiscal consequences of shifting from a voluntary system to a compulsory one under two assumptions: (i) that the policy planner calculates the consequences for the unemployment fund alone, a nonintegrated computation, and (ii) that he considers the consequences for both the unemployment fund and social assistance, an integrated computation.

This distinct is an important one in the Danish system; under current Danish administrative rules, eligibility for unemployment insurance preempts eligibility for social assistance, at least as a matter of right. Under this rule, net revenue gains from compulsion in an integrated approach may be very large indeed, as a modest UI benefit may preempt a more substantial SA benefit. That is not a problem in the current voluntary system because rational consumers will not choose to join a U-Fund if they could expect to receive greater benefits under social assistance. With conversion to a compulsory system, the number of such perverse cases is likely to multiply. Indeed it is likely that low wage workers, disadvantaged in this way will be

[21] These estimates can also be interpreted as measures of the adverse selection losses of the current

protected, perhaps by placing a floor on unemployment benefit levels that insures that

the individual's unemployment benefits do not fall below the social assistance

benefits for which the individual was previously eligible. When considering the

integrated model, we will calculate the revenue gains from compulsion under the

current system and under a program in which unemployment benefits are

automatically raised to cover SA benefits foregone plus the fund membership fee the

worker is required to pay under the compulsory system.[22]

Consider first the impact of universal compulsion on the U-Fund alone. The

calculation of the revenue gain is a simple one: for each individual in our sample who

is not currently (1995) a U-fund member, we subtract the expected annual benefit

payouts from the fee the individual is required to pay, and then sum across all

nonmembers:

$$R^* = \sum_{i=1}^{N} R_i^* = \sum_{i=1}^{N} (f_i - \theta_i B_i)$$

where:

R^*:   The aggregate U-fund revenue gain from universal compulsion; and

N: Nonparticipants in the voluntary U-fund.

Theory would suggest that R_i^* is a positive number for all *rational* non-participants in

the unemployment fund; that is that fees should exceed expected payouts. This need

not be the case if workers are myopic. Also nonparticipants who rely on social

assistance during unemployment spells may forego positive net expected

system

[22] The "fee" in a compulsory system is essentially a form of payroll tax. For simplicity, we will assume the membership fee remains in place in a compulsory system, although that is only a question of terminology.

unemployment benefits if the preempted social assistance is more generous than net unemployment benefits.

The revenue gain calculations under compulsion are reported in Column 1 of Table 7 for the total sample and for various demographic subgroups, adjusted upward by a factor of ten to account for the fact that we are using a ten percent sample. The net gains are positive, although not large. The net revenue gain in 1995 is about 80 million DKK of a total expenditure of about 25 billion DKK, or about 0.3 percent of the budget. Looking at the demographic breakdown of the revenue sources, perhaps the most surprising result is that revenue gains from compulsion would be negative for large groups of workers. For women as a whole and for low skilled workers, the system would pay out more in benefits than it collected in fees. This finding does not mean that these workers are economically irrational or myopic in any way, because their rational private decision algorithm must include the social assistance benefits foregone by joining the fund. In isolation it may make sense to belong to a U-fund, but if social assistance were to pay, say the same benefit without paying the membership fee, the sense of joining is lost. The social assistance effect is apparent in the distribution of revenue gains across population deciles as well; the net revenue gain to the U-fund is negative for five of the six lowest income deciles, Table 8, Columns 1. Even among high income workers, the aggregate gains are small. If it were possible to limit compulsion to the top four deciles of the income distribution, the gains would be only 260 million DKK, or one percent of program expenditures.

The fact that U-fund members are no longer eligible for social assistance benefits provides an addition potential government revenue gain in a broader

calculation that includes social assistance savings. We make a second computation, adding social assistance savings to the revenue gain from compulsion. It is possible to calculate these savings in a manner similar to that of the last section: the aggregate (U-fund plus social assistance) revenue gain from the transition to a universal, compulsory system can be computed as:

$$R^{**} = \sum_{1}^{N} [f_i - \theta(B_i - S_i)]$$

where again S_i denotes the social assistance payment for which the ith uncovered worker is eligible if he or she became unemployed. Clearly preempting social assistance payments contributes positively to the government's revenue gains from the introduction of compulsion, although the magnitude of the effect is uncertain. The results of this computation, in aggregate and by demographic group are reported in Table 7, column 2. In the sample, the government saving to the combined U-fund and social assistance program, 2.78 billion DKK, a substantial figure compared to the small gains to the U-fund alone, but still a modest part of total U-fund expenditures, a little over 1 percent.

Any program change whose primary financial gain comes from social assistance savings is likely to have troubling distributional effects and this is clear from the demographic breakdowns in Tables 7 and 8. About two thirds of the projected cost saving comes from primary education workers, Table 7, Column 2. Almost eighty percent of the program revenue gain from compulsion would be extracted from the lowest 30 percent of the gross income distribution, Table 8, Column 2.

These revenue gains are probably illusory to the extent that they reduce the reduced economic well-being of low skilled, unemployed workers. A more

meaningful calculation is the revenue gains to compulsion that arise when the economic well-being of social assistance beneficiaries is protected. Within the context of the U-fund, this is equivalent to assuming that unemployment fund benefits cannot be less than the social assistance benefits for which the unemployed worker is currently (1995) eligible *plus* the membership fee. Denote by R^{***} the aggregate revenue gain when the economic well-being of current social assistance eligibles is protected, so that.

$$R^{***} = \sum_{1}^{N} [f_i + \theta S_i - \theta \max\{0, (B_i, S_i + f_i)\}].$$

With this benefit protection, the total government saving in the two programs is about 35 percent of the combined saving without that protection, or 970 million DKK, about 0.4 percent of 1995 total U-fund expenditures, Table 7, Column 3.[23] Almost all these savings are generated from social assistance eligibles who do not become unemployed, yet now must pay the U-fund membership fee. The distributional consequences are self-evident. Even with the benefit protection, almost half of the revenue gain comes from workers with basic education, Table 7, Column 3, and from the lowest three deciles of the earnings distribution, Table 8, Column 3. The unfavorable redistributional aspect may explain why Sweden's experiment in the early 1990s with compulsion was reversed after only a year.

X. Conclusion

Adverse selection is generally believed to be a serious limitation to third party unemployment insurance markets, providing a strong argument for compulsion in a

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[23] We have ignored possible adverse effects on low-wage workers' labor supply now that the difference between their net wage income and SA-benefits is reduced. The entire construction with a voluntary system and relatively high SA-benefits functions in fact like an "earned income tax credit" which is then removed in our third experiment.

public program if the program is known to be universally valuable to users.[24]   Of

course such selection assumes that workers are rational and able to calculate the

actions that will maximize their well-being, a claim that many serious students of

social insurance systems reject in favor of the belief that workers are myopic in

saving and insurance situations, Diamond (1993). By what is perhaps an historical

accident, the Danish system, which developed out of trade union programs, is

voluntary although heavily subsidized. The evidence is compelling that workers do

behave strategically. Although large subsidies limit the nonparticipating portion of

the labor force to about 20 percent, workers who choose to opt out of the system have

good economic reasons for behaving as they do.

The fixed unemployment fund fee and fixed benefits for most workers above a

relatively low ceiling leads to the hypothesis that fund membership should be quite

sensitive to unemployment expectations, an hypothesis that the data strongly

confirm.[25] The same simple model predicts that workers will be more likely to join if

U-fund benefits are higher, given the fee and unemployment risk, a prediction that is

also supported by our estimates.

An additional factor of special importance in a welfare state is the impact of

alternative social insurance programs, especially social assistance. For a significant

number of individuals, social assistance is more generous than unemployment

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[24] If a significant subset of the population does not value the program at cost, a voluntary system may
be more valuable, permitting the government to identify workers who value the program at cost.

[25] These significant adverse selection estimates of the voluntary public system cannot be carried over to
private insurance systems. The total absence of risk underwriting makes the adverse selection losses
especially severe, so it is hard to assess the extent of adverse selection under optimal underwriting. On
the other hand it is difficult to conceive of a voluntary *public* system that incorporates severe
underwriting procedures, and it is easy to imagine that the adverse selection losses would be much
larger were the subsidization rate any less extravagant.

benefits net of the required membership fee. Although the high degree of fund nonparticipation among low-wage workers could be explained by "myopia," we present evidence that it is rather the result of a purposeful calculation that includes alternative benefit sources. At least among the relatively well-educated and well-counseled Danes, low wage workers appear quite competent to pursue their economic self-interest.

The interaction of the U-fund with social assistance raises an important redistributional consideration into the question of conversion to a universal compulsory system. The projected revenue gains of such a conversion, although not large, are also not inconsequential. We estimate that the net gain to the unemployment funds (fees collected less expected benefit disbursements) would be on the order of 2.78 billion DKK if the implicit savings from the preempted social assistance payments are included as revenue gains. Alas a significant share of the increased revenue, more than half, comes from low skilled workers. If we assume that unemployment benefits are adjusted upward so that social assistance eligibles are made no worse off by the transition to a compulsory system, the redistribution is less stark, but the net revenue gains from the transition are less grand as well, shrinking by 60 percent. Even then the remaining revenue gains are extracted disproportionately from the unskilled, but the redistributional effects are more modest. It may not be accidental that the voluntary systems remain in place in welfare states.

Another potential advantage to a voluntary unemployment system in the welfare state, one that leads us beyond the scope of the present study, is *transparency*. Especially in a high tax environment, the tax wedge, the differential between the worker's perception of the value of her compensation and the firm's cost of hiring an additional worker, is likely to be quite large, inducing a variety of labor supply and

productivity inefficiencies. In a voluntary system at least the unsubsidized portion of the unemployment fee is valued by the worker--after all she receives the wage payment and then commits the amount of the fee to purchase unemployment insurance. To that degree the "tax wedge" and any related distortions are reduced. The importance of transparency as a rationale for a voluntary system is beyond our calculation.

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TABLE 1a

VARIABLE DEFINITIONS

U   A zero-one dummy, with one indicating the worker was unemployed all of week 48 (4th week of November)

UF   A zero-one dummy, with one indicating the worker was a member of an unemployment fund

$\hat{U}$ The probability a worker is unemployed all of week 48, derived from the unemployment probit reported in Table 2, column 3

$\hat{U}$ -PE   The probability a worker is unemployed all of week 48, derived from the unemployment probit reported in Table 6a

B-UF   The projected annual unemployment fund benefits the worker would qualify for if unemployed (in 10,000 DKK)

B-SA   The projected annual social assistance benefits the worker would qualify for if unemployed (in 10,000 DKK)

FEMALE   A zero-one dummy, with one indicating the worker is female

AGE16-24   A zero-one dummy, with one indicating the worker is age 16 to 24

AGE25-29   A zero-one dummy, with one indicating the worker was age 25 to 29

AGE30-34   A zero-one dummy, with one indicating the worker age 30 to 34

AGE35-39   A zero-one dummy, with one indicating the worker age 35 to 39

AGE40-49   A zero-one dummy, with one indicating the worker age 40-49

AGE50-59   A zero-one dummy, with one indicating the worker was age 50 to 59

AGE60-66   A zero-one dummy, with one indicating the worker was age 60 to 66

ED1   A zero-one dummy, with one indicating the worker's highest grade completed was 9 or primary education

ED2   A zero-one dummy, with one indicating the worker's highest grade completed was 10

ED3   A zero-one dummy, with one indicating the worker's highest grade completed was "gymnasium"

ED4   A zero-one dummy, with one indicating the worker's highest grade completed was "skilled by vocational training"

ED5   A zero-one dummy, with one indicating the worker's highest grade completed was short term tertiary education

ED6   A zero-one dummy, with one indicating the worker's highest grade completed was medium-term tertiary education

ED7   A zero-one dummy, with one indicating the worker's highest grade completed was long-term tertiary education

UNSK	A zero-one dummy, with one indication the worker's occupation is unskilled worker
SKLD	A zero-one dummy, with one indication the worker's occupation is skilled worker
MNGR	A zero-one dummy, with one indication the worker's occupation is manager.
SE	A zero-one dummy, with one indication the worker's occupation is self-employed.
LEAVE	A zero-one dummy, with one indication the worker's occupation is "on leave."
STUDENT	A zero-one dummy, with one indication the worker's occupation is student
OLF/PEN	A zero-one dummy, with one indication the worker's occupation is "on pension" or out of the labor force
AGRIC	A zero-one dummy, with one indicating the worker's industry of employment is agriculture
MANUF	A zero-one dummy, with one indicating the worker's industry of employment is manufacturing
CONST	A zero-one dummy, with one indicating the worker's industry of employment is construction
WHOLE	A zero-one dummy, with one indicating the worker's industry of employment is wholesale
RETAIL	A zero-one dummy, with one indicating the worker's industry of employment is retail
CATERING	A zero-one dummy, with one indicating the worker's industry of employment is catering
TRANS	A zero-one dummy, with one indicating the worker's industry of employment is transport
FINANCE	A zero-one dummy, with one indicating the worker's industry of employment is finance
SERV-LOW	A zero-one dummy, with one indicating the worker's industry of employment is low skilled service
SERV-HG	A zero-one dummy, with one indicating the worker's industry of employment is high skilled service
PUBLIC	A zero-one dummy, with one indicating the worker's industry of employment is public sector
U-YR	The fraction of the year unemployed
UF/SA	A zero-one dummy, with one indicting receipt of either unemployment benefits or social assistance or both in the calendar year
GROSSINC	Gross annual income (in 10,000 DKK)

WEALTH   Physical asset wealth (in 10,000 DKK)

P_WEALTH Parental physical asset wealth (in 10,000 DKK)

MARRIED   A zero-one dummy, with one indicating the worker is married

CHILD0   A zero-one dummy, with one indicating the worker has no children living in the household

CHILD1-3   A zero-one dummy, with one indicating the worker has one to three children living in the household

CHILD4+   A zero-one dummy, with one indicating the worker has four or more children living in the household

TABLE 1b

SUMMARY STATISTICS FOR UNEMPLOYMENT AND U-FUND PROBITS
DENMARK 1995

Variable	Mean	Std. Dev.	Variable	Mean	Std. Dev.
U	0.083	0.276	MANUF	0.175	0.380
UF	0.822	0.382	IWHOLE	0.056	0.230
$\hat{U}$	0.083	0.141	CONST	0.052	0.223
FEMALE	0.447	0.497	RETAIL	0.051	0.219
AGE16-24	0.110	0.313	CATERING	0.018	0.133
AGE25-29	0.122	0.327	TRANS	0.060	0.238
AGE30-34	0.139	0.346	FINANCE	0.028	0.166
AGE35-39	0.130	0.336	SERV-LOW	0.060	0.237
AGE35-39	0.265	0.442	SERV-HIGH	0.040	0.195
AGE50-59	0.193	0.395	PUBLIC	0.283	0.450
AGE60-66	0.040	0.197	U-YR94	0.100	0.238
ED2	0.108	0.310	U94	0.079	0.270
ED3	0.039	0.193	B-UF	10.861	4.111
ED4	0.414	0.493	B-SA	3.486	4.265
ED5	0.066	0.249	UF/SA94	0.355	0.479
ED6	0.092	0.289	GROSSINC94	19.980	41.471
ED7	0.052	0.222	WEALTH94	9.341	165.344
SKLD94	0.326	0.469	GROSSINC	21.054	43.552
MNGR94	0.227	0.419	WEALTH	10.141	169.080
SE94	0.071	0.256	MARRIED	0.535	0.499
LEAVE94	0.025	0.155	CHILD1-3	0.393	0.488
STUDENT94	0.007	0.081	CHILD4+	0.008	0.089
OLF/PEN94	0.002	0.041			
Number of observations					244695

Note: All variables refer to 1994 unless otherwise noted.

TABLE 2
UNEMPLOYMENT PROBITS, DENMARK 1995

Variables	(1) Coef.	z	(2) Coef.	z
CONSTANT	-1.552	*-77.02*	-1.284	*-52.28*
FEMALE	0.086	*9.01*	0.065	*6.63*
AGE16-24	0.070	*4.20*	-0.038	*-2.26*
AGE25-29	-0.001	*-0.08*	-0.031	*-1.96*
AGE30-34	-0.034	*-2.16*	-0.053	*-3.35*
AGE35-39	-0.007	*-0.43*	-0.016	*-0.93*
AGE50-59	0.220	*14.93*	0.231	*15.60*
AGE60-66	0.346	*14.39*	0.319	*13.20*
ED2	-0.082	*-5.58*	-0.080	*-5.41*
ED3	-0.095	*-4.22*	-0.100	*-4.43*
ED4	-0.162	*-14.23*	-0.128	*-11.07*
ED5	-0.271	*-11.70*	-0.260	*-11.12*
ED6	-0.388	*-15.71*	-0.362	*-14.52*
ED7	-0.259	*-9.18*	-0.246	*-8.58*
SKLD	-0.093	*-7.11*	-0.049	*-3.73*
MNGR	-0.254	*-13.31*	-0.193	*-9.99*
SE	-0.408	*-17.08*	-0.459	*-18.83*
LEAVE	0.431	*18.92*	0.341	*14.72*
STUDENT	0.410	*10.10*	0.263	*6.39*
OLF/PEN	-0.936	*-5.23*	-1.198	*-6.74*
MANUF	-0.399	*-22.30*	-0.266	*-14.35*
CONST	-0.389	*-15.81*	-0.254	*-10.13*
WHOLE	-0.306	*-11.33*	-0.191	*-6.95*
RETAIL	-0.188	*-7.69*	-0.121	*-4.90*
CATERING	-0.063	*-2.02*	0.009	*0.28*
TRANS	-0.395	*-15.40*	-0.264	*-10.09*
FINANCE	-0.197	*-5.30*	-0.080	*-2.12*
SERV-LOW	-0.309	*-12.57*	-0.222	*-8.89*
SERV-HG	-0.378	*-11.55*	-0.279	*-8.44*
PUBLIC	-0.315	*-18.54*	-0.227	*-13.03*
MARRIED	-0.125	*-11.79*	-0.063	*-5.42*
CHILD1-3	-0.105	*-9.23*	-0.104	*-9.00*
CHILD4+	-0.032	*-0.70*	-0.100	*-2.12*
U-YR94	0.967	*48.51*	0.671	*30.86*

U94	0.353	*18.76*	0.432	*22.60*
UF/SA94	0.589	*50.72*	0.577	*49.31*
B-UF			-0.037	*-29.75*
B-SA			0.014	*11.86*
GROSSINC94			-0.002	*-6.94*
WEALTH94			0.0001	*4.47*
Log likelihood	-49053		-48440	
LR χ^2	41767		42993	
P-value of χ^2	0.0000		0.0000	
Pseudo-R^2	0.2986		0.3074	
Number of observations	244695		244695	

Note: The dependent variable is U95. The base group is males belonging to the age interval 40-49, single with no children, only basic education and working in the agricultural sector as unskilled labor.

TABLE 3
PROBIT ESTIMATES OF UNEMPLOYMENT FUND MEMBERSHIP
WITH CORRESPONDING LINEAR APPROXIMATIONS,
DENMARK 1995

Variable	Coef	DF/dx	z	Coef	DF/dx	z
CONSTANT	-0.554		-46.54	-0.620		-34.19
$\hat{U}$	2.850	0.687	92.74	2.594	0.590	80.37
B-UF95	0.134	0.032	144.57	0.133	0.030	123.97
B-SA95	-0.037	-0.009	-50.90	-0.023	-0.005	-26.70
GINC95				-0.009	-0.002	-35.28
WEALTH95				-0.0004	-0.0001	-9.29
CHILD1-3				0.084	0.019	10.03
CHILD4+				-0.109	-0.026	-3.17
MARRIED				0.115	0.026	13.20
FEMALE				0.308	0.069	43.53
Age16-24				-0.472	-0.128	-37.67
Age25-29				0.049	0.011	3.96
Age30-34				-0.005	-0.001	-0.47
Age35-39				-0.085	-0.020	-7.46
Age50-59				-0.043	-0.010	-3.96
Age60-66				-0.787	-0.243	-49.08
ED2				-0.055	-0.013	-4.70
ED3				-0.298	-0.078	-18.73
ED4				0.387	0.085	43.86
ED5				0.188	0.039	12.77
ED6				0.036	0.008	2.83
ED7				-0.0001	-0.00002	-0.01
Log likelihood	-101892			-94070		
LR χ^2	25046			40689		
P-value of χ^2	0.0000			0.0000		
Pseudo-R^2	0.1095			0.1778		
Number of observations	244695			244695		

Note: The dependent variable is UF95.
Note: The base group is males belonging to the age interval 40-49, single with no children, only basic education, and working in agriculture as an unskilled laborer.

PROBIT ESTIMATES OF UNEMPLOYMENT FUND MEMBERSHIP
WITH CORRESPONDING LINEAR APPROXIMATIONS, BY AGE
DENMARK 1995

Age < 35	COEFF	dF/dx	z	MEAN
$\hat{U}$	2.806	0.725	56.19	0.099
B-UF	0.130	0.034	78.78	9.777
B-SA	-0.027	-0.007	-20.43	4.508
GROSSINC	-0.007	-0.002	-11.01	16.592
WEALTH95	0.000	0.000	0.30	-0.965
MARRIED	0.205	0.051	12.93	0.280
FEMALE	0.296	0.075	25.44	0.447
CHILD1-3	0.158	0.040	10.57	0.380
CHILD4+	-0.069	-0.018	-1.06	0.006
AGE18-24	-0.290	-0.079	-18.67	0.297
AGE25-29	0.102	0.026	7.34	0.328
ED2	0.039	0.010	2.36	0.164
ED3	-0.167	-0.046	-7.85	0.066
ED4	0.635	0.158	42.68	0.442
ED5	0.648	0.123	22.57	0.051
ED6	0.618	0.121	22.89	0.064
ED7	0.555	0.110	17.87	0.038
CONST	-0.944		-34.30	
Log likelihood		-36680		
LR χ^2		22976		
P-value of χ^2		0.0000		
Pseudo-R^2		0.2385		
Number of obs.		90788		

Note: The dependent variable is UF95.

PROBIT ESTIMATES OF UNEMPLOYMENT FUND MEMBERSHIP
WITH CORRESPONDING LINEAR APPROXIMATIONS, BY AGE
DENMARK 1995

35 < Age < 46	COEFF	dF/dx	z	MEAN
$\hat{U}$	1.593	0.321	22.69	0.067
B-UF	0.112	0.023	47.08	11.526
B-SA	-0.022	-0.004	-13.34	3.299
GROSSINC	-0.013	-0.003	-25.92	22.640
WEALTH	-0.0002	-0.00004	-2.21	3.987
MARRIED	0.101	0.021	6.24	0.621
FEMALE	0.308	0.061	21.32	0.462
CHILD1-3	0.092	0.019	5.80	0.678
CHILD4+	-0.090	-0.019	-2.03	0.020
AGE35-40	-0.079	-0.016	-6.00	0.503
ED2	0.095	0.018	3.96	0.127
ED3	-0.242	-0.055	-7.09	0.034
ED4	0.251	0.049	13.23	0.391
ED5	0.051	0.010	1.93	0.091
ED6	-0.006	-0.001	-0.24	0.110
ED7	0.067	0.013	2.29	0.066
CONST	-0.198		-5.25	
Log likelihood		-23302		
LR χ^2		4259		
P-value of χ^2		0.0000		
Pseudo-R^2		0.0837		
Number of obs.		63271		

Note: The dependent variable is UF95.

PROBIT ESTIMATES OF UNEMPLOYMENT FUND MEMBERSHIP
WITH CORRESPONDING LINEAR APPROXIMATIONS, BY AGE
DENMARK 1995

46 < Age < 60	COEFF	dF/dx	z	MEAN
$\hat{U}$	2.691	0.498	42.16	0.073
B-UF	0.141	0.026	66.65	11.670
B-SA	-0.022	-0.004	-10.86	2.568
GROSSINC	-0.007	-0.001	-21.16	24.514
WEALTH	-0.0004	-0.0001	-7.54	22.153
MARRIED	0.068	0.013	3.74	0.730
FEMALE	0.259	0.047	20.03	0.444
CHILD1-3	-0.010	-0.002	-0.63	0.229
CHILD4+	-0.092	-0.018	-0.83	0.002
AGE40-49	0.107	0.020	8.24	0.415
ED2	-0.149	-0.030	-4.83	0.038
ED3	-0.302	-0.066	-6.97	0.015
ED4	0.260	0.047	17.13	0.410
ED5	-0.059	-0.011	-2.37	0.066
ED6	-0.274	-0.058	-13.98	0.109
ED7	-0.382	-0.086	-15.39	0.054
CONST	-0.601		-17.31	
Log likelihood		-27534		
LR χ^2		7360		
P-value of χ^2		0.0000		
Pseudo-R^2		0.1179		
Number of obs.		80784		

Note: The dependent variable is UF95.

TABLE 4d

PROBIT ESTIMATES OF UNEMPLOYMENT FUND MEMBERSHIP
WITH CORRESPONDING LINEAR APPROXIMATIONS, BY AGE
DENMARK 1995

Age > 60	COEFF	dF/dx	z	MEAN
$\hat{U}$	4.167	1.590	34.92	0.120
B-UF	0.169	0.064	38.79	9.941
B-SA	-0.003	-0.001	-0.59	2.794
GROSSINC	-0.006	-0.002	-10.24	23.632
WEALTH	-0.001	-0.0003	-9.14	53.537
MARRIED	-0.037	-0.014	-0.77	0.732
FEMALE	0.085	0.032	2.67	0.371
CHILD1-3	0.151	0.056	1.42	0.018
ED2	-0.085	-0.033	-1.17	0.041
ED3	0.026	0.010	0.19	0.011
ED4	0.371	0.138	10.91	0.344
ED5	0.227	0.083	3.22	0.043
ED6	-0.049	-0.019	-0.98	0.095
ED7	-0.256	-0.100	-4.34	0.068
CONST	-1.821		-23.40	
Log likelihood		-5195		
LR χ^2		2871		
P-value of χ^2		0.0000		
Pseudo-R^2		0.2165		
Number of obs.		9851		

Note: The dependent variable is UF95.

TABLE 5a
PROBIT ESTIMATES OF UNEMPLOYMENT BASED ON PARENTAL EDUCATION AND WEALTH WITH CORRESPONDING LINEAR APPROXIMATIONS, DENMARK 1995

Age < 35	COEFF	dF/dx	z	MEAN
female	0.245	0.035	6.49	0.435
age18	-0.532	-0.051	-3.86	0.039
age19	-0.301	-0.034	-2.36	0.033
age20	-0.303	-0.034	-2.70	0.045
age21	0.003	0.0003	0.03	0.058
age22	0.204	0.032	2.40	0.057
age23-24	0.154	0.023	2.19	0.118
age27-28	-0.126	-0.016	-1.75	0.140
age29-30	-0.240	-0.029	-3.26	0.149
age31-32	-0.209	-0.026	-2.77	0.129
age33-34	-0.231	-0.028	-2.92	0.112
Pedu1	-0.072	-0.009	-0.91	0.073
Pedu2	0.134	0.019	1.54	0.293
Pedu3	-0.352	-0.037	-1.03	0.005
Pedu4	-0.005	-0.001	-0.06	0.472
Pedu5	-0.013	-0.002	-0.13	0.833
Pedu6	0.079	0.010	0.65	0.935
Pedu7	-0.325	-0.056	-2.19	0.974
P_WEALTH	-0.002	-0.0002	-3.72	21.425
CONST	-1.183		-10.14	
Log likelihood		-2616		
LR χ^2		164		
P-value of χ^2		0.0000		
Pseudo-R^2		0.0303		
Number of obs.		9806		

TABLE 5b
PROBIT ESTIMATES OF UNEMPLOYMENT FUND MEMBERSHIP
BASED ON PARENTAL EDUCATION AND WEALTH
WITH CORRESPONDING LINEAR APPROXIMATIONS,
DENMARK 1995

Age < 35	COEFF	dF/dX	z	COEFF	dF/dx	z	MEAN
CONST	-0.297		-5.25	0.430		4.03	
$\hat{U}$ -PE	6.260	1.685	14.07	3.144	0.836	3.25	0.079
B-UF	0.101	0.027	30.74	0.070	0.019	15.06	10.020
B-SA	-0.065	-0.017	-16.88	-0.033	-0.009	-7.79	4.946
Female				0.122	0.032	2.50	0.435
age18				-1.854	-0.646	-14.79	0.039
age19				-1.396	-0.502	-13.68	0.033
age20				-1.017	-0.356	-11.51	0.045
age21				-0.788	-0.265	-10.58	0.058
age22				-0.496	-0.156	-5.78	0.057
age23-24				-0.254	-0.073	-3.50	0.118
age27-28				-0.027	-0.007	-0.40	0.140
age29-30				0.093	0.024	1.24	0.149
age31-32				-0.057	-0.016	-0.75	0.129
age33-34				-0.022	-0.006	-0.27	0.112
CHILD1-4				0.109	0.029	2.24	0.344
MARRIED				0.149	0.038	2.92	0.252
GROSSINC				-0.010	-0.003	-4.81	16.997
WEALTH				0.0004	0.0001	0.52	-1.060
Log likelihood	-4318			-3874			
LR χ^2	1755			2644			
P-value of χ^2	0.0000			0.0000			
Pseudo-R^2	0.1689			0.2544			
Number of obs.	9806			9806			

PROBIT ESTIMATES OF UNEMPLOYMENT FUND MEMBERSHIP
WITH CORRESPONDING LINEAR APPROXIMATIONS
FOR 1993-NON-MEMBERS (UF93 = 0), BY AGE
DENMARK 1995

Age < 35	COEFF	dF/dx	z	MEAN
$\hat{U}$	1.555	0.593	20.92	0.100
B-UF95	0.076	0.029	31.75	7.557
B-SA95	-0.005	-0.002	-2.48	5.615
GINC95	-0.004	-0.002	-4.43	13.936
WEALTH95	-0.001	0.000	-3.15	-0.373
MARRIED*	-0.039	-0.015	-1.54	0.183
FEMALE*	-0.169	-0.062	-1.36	0.005
CHILD1-3*	0.102	0.039	3.67	0.129
CHILD4+*	0.312	0.119	18.79	0.410
AGE18-24	0.266	0.100	12.21	0.590
AGE30-34	-0.483	-0.173	-19.23	0.193
ED2*	-0.096	-0.036	-4.03	0.231
ED3*	-0.010	-0.004	-0.34	0.121
ED4*	0.719	0.277	31.61	0.307
ED5*	1.003	0.379	22.11	0.033
ED6*	1.084	0.405	26.56	0.046
ED7*	1.267	0.457	28.83	0.038
CONST	-1.468		-39.49	
Log likelihood		-17914		
LR χ^2		5404		
P-value of χ^2		0.0000		
Pseudo-R^2		0.1311		
Number of obs.		30715		

Note: The dependent variable is UF95. Age25-29 is in the reference group

TABLE 6b

PROBIT ESTIMATES OF UNEMPLOYMENT FUND MEMBERSHIP
WITH CORRESPONDING LINEAR APPROXIMATIONS
FOR 1993-NON-MEMBERS (UF93 = 0), BY AGE
DENMARK 1995

35 ≤Age < 46	COEFF	dF/dx	z	MEAN
$\hat{U}$	0.107	0.033	0.84	0.075
B-UF95	0.035	0.011	8.43	10.346
B-SA95	-0.002	-0.001	-0.50	4.162
GINC95	-0.008	-0.002	-8.41	25.043
WEALTH95	-0.001	-0.0003	-3.77	7.791
MARRIED*	0.062	0.019	1.87	0.613
FEMALE*	0.059	0.019	0.72	0.030
CHILD1-3*	-0.005	-0.002	-0.16	0.551
CHILD4+*	0.298	0.095	10.13	0.365
AGE30-39	-0.117	-0.037	-4.33	0.518
ED2*	0.024	0.008	0.49	0.122
ED3*	-0.056	-0.017	-0.86	0.059
ED4*	0.114	0.036	2.88	0.307
ED5*	0.0002	0.0001	0.00	0.088
ED6*	0.020	0.006	0.39	0.127
ED7*	-0.001	-0.0003	-0.02	0.083
CONST	-0.984		-15.07	
Log likelihood		-5824		
LR χ^2		342		
P-value of χ^2		0.0000		
Pseudo-R^2		0.0285		
Number of obs.		10645		

Note: The dependent variable is UF95. Age40-49 is in the reference group

PROBIT ESTIMATES OF UNEMPLOYMENT FUND MEMBERSHIP
WITH CORRESPONDING LINEAR APPROXIMATIONS
FOR 1993-NON-MEMBERS (UF93 = 0), BY AGE
DENMARK 1995

46 ≤Age	COEFF	dF/dx	z	MEAN
$\hat{U}$	1.033	0.154	7.55	0.057
B-UF95	0.054	0.008	12.79	9.988
B-SA95	0.001	0.0002	0.30	2.936
GINC95	-0.005	-0.001	-6.87	29.513
WEALTH95	-0.001	-0.0001	-6.75	53.531
MARRIED*	0.087	0.013	2.27	0.193
FEMALE*	0.136	0.022	0.55	0.003
CHILD1-3*	-0.066	-0.010	-1.56	0.704
CHILD4+*	0.257	0.040	8.31	0.367
AGE50-59	-0.157	-0.023	-4.68	0.453
AGE60-66	-0.669	-0.080	-13.50	0.252
ED2*	0.032	0.005	0.45	0.047
ED3*	-0.060	-0.009	-0.59	0.023
ED4*	0.203	0.032	5.50	0.266
ED5*	0.009	0.001	0.15	0.065
ED6*	-0.243	-0.032	-4.90	0.154
ED7*	-0.345	-0.042	-5.29	0.108
CONST	-1.638		-22.16	
Log likelihood		-4561		
LR χ^2		827		
P-value of χ^2		0.0000		
Pseudo-R^2		0.0831		
Number of obs.		14959		

Note: The dependent variable is UF95. Age40-49 is in the reference group

TABLE 7

POTENTIAL REVENUE GAINS OF COMPULSORY UI:
DENMARK 1995 (in ten mill. DKK)

	OBS.	(1) R^*	(2) R^{**}	(3) R^{***}
Total	50833	8	278	97
Men	22816	11	163	66
Women	28017	-3	115	31
PRIMARY ED	24339	-15	163	43
SECONDARY	14130	3	51	23
SHORT TERT.	2841	5	8	6
MEDIUM TERT.	4456	10	14	12
LONG TERT.	2959	7	10	8

Note: The alternative models of the revenue gain from compulsion are defined in the text. The sample estimates have been expanded by a factor of ten to reflect population values.

TABLE 8

POTENTIAL REVENUE GAINS OF COMPULSORY UI
BY POPULATION GROSS INCOME DECILES
DENMARK 1995 (in ten mill. DKK)

Decile	Max Gross Inc. (in DKK)	OBS.	(1) R^{*}	(2) R^{**}	(3) R^{***}
1	112348	17021	4	174	36
2	140650	6386	-9	34	8
3	163929	4190	-7	13	4
4	185550	2919	-3	8	3
5	205030	2365	-2	5	3
6	225002	2135	-0.3	4	3
7	249307	2349	1	5	4
8	283083	3452	5	9	8
9	351597	3905	7	10	10
10	1.96e+08	6111	13	17	17

Note: The alternative models of the revenue gain from compulsion are defined in the text. The sample estimates have been expanded by a factor of ten to reflect population values.
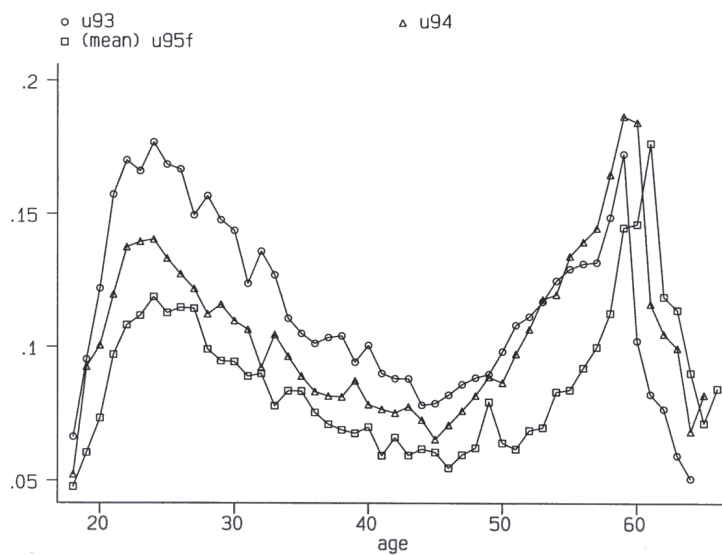
FIGURE 1a

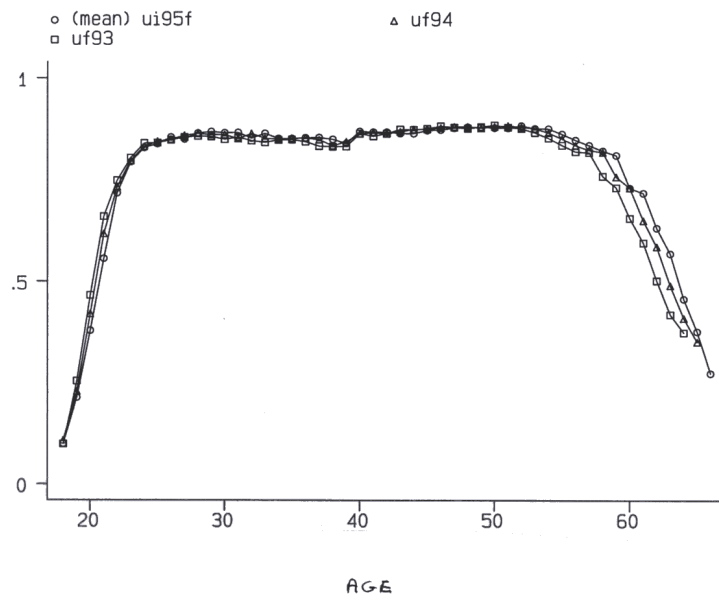UNEMPLOYMENT BY AGE, 1993-1995

FIGURE 1b

U-FUND MEMBERSHIP BY AGE, 1993-1995

55

FIGURE 1c

SA ELIGIBILITY BY AGE, 1993-1995